WHAT IS CLAIMED IS:

1. A method for obtaining measurements of strength related characteristics of a part, the method comprising:

providing a portable x-ray diffraction unit including an x-ray head having integrated adjustment mechanisms for shifting the head in a plurality of different directions;

transporting the portable unit to a site at which the part is in service;

orienting the x-ray head relative to the part for directing x-rays thereat;

shifting the x-ray head via the adjustment mechanisms to direct x-rays at various positions on the part for obtaining a sufficiently large distribution range of measurements of the desired part characteristics for proper strength analysis thereof;

detecting the diffraction of the x-rays from the part at the various positions thereon;

transmitting signals to a controller for the portable unit that are based on the detected x-rays;

interpreting the signals in circuitry of the controller to render measurements of at least one strength related characteristic of the part; and

generating a map at the part site of the part characteristic across the entire distribution range of measurements for the part.

2. The method of claim 1 including sensing when the head is shifted to a focus position a predetermined distance from the part, signaling the controller when the focus position has been reached, storing in memory of the controller the position of the adjustment mechanisms to keep the head at the focus position, and operating the adjustment mechanisms via the stored positions to precisely shift the head to the focus position in a repeatable manner.

3. The method of claim 2 wherein the positions on the part to be measured are on different level surfaces of the part or on curved surfaces of the part, an operator shifts the head to different positions from which it is desired to direct x-rays at the part positions via the adjustment mechanisms, storing the positions of the adjustment mechanisms associated with the different head positions in the controller for mapping a desired path of movement of the

head for taking measurements from the different part positions, and causing the head to undergo the desired path of movement to allow measurements to be taken from complexly shaped parts without requiring movement thereof.

4. The method of claim 1 wherein the part includes a curved surface and the adjustment mechanisms include a rotary adjustment mechanism, and the x-ray head is shifted by rotating the head via the rotary adjustment mechanism about an internal axis of the head to substantially maintain the head at a predetermined distance from the part curved surface for directing x-rays at positions thereon without requiring movement of the part.

5. The method of claim 1 including initializing the position of the head relative to the part, storing the part contour in a memory of the controller, and causing the head to shift from the initialized position by the adjustment mechanisms to keep a substantially constant distance from the part based on the stored part contour.

6. The method of claim 1 wherein the x-ray head is oriented relative to the part by mounting the unit to the part so that the part does not have to be taken out of service to obtain the strength related characteristics thereof.

7. The method of claim 6 wherein the part is a cable for a bridge, the unit is transported to a part site by transporting the unit to the bridge, and the unit is mounted to the part by releasably clamping the unit via a fixture thereof to the bridge cable.

8. The method of claim 1 wherein the part strength related characteristic is stress and the map is generated by creating a map curve line interconnecting the stress measurement for each position across the distribution range of positions measured on the part for graphically showing areas of stress concentration in the distribution range on the map.

9. A method of measuring strains on load bearing members while the members are subject to loads, the method comprising:

providing an x-ray diffraction apparatus;

mounting the apparatus to a load bearing member while it is subject to loading;

adjusting a fixture for the apparatus to the size of the load bearing member to be measured to allow the apparatus to be used with different sizes of load bearing members;

measuring the strains of the load bearing member with the apparatus.

10. The method of claim 9 wherein the load bearing members are wire rope, single strand or multi-strand cables supporting load bearing structures, or individual strands of a cable bundle or wire rope.

11. The method of claim 9 wherein the load bearing members are measured while in situ as tension members for bridge structures.

12. A method for taking x-ray diffraction measurements from parts having multi-level or curved surfaces, the method comprising:

providing a x-ray head that is shiftable in a plurality of different directions;

teaching a controller for the x-ray head the shape of a portion of a part from which measurements are desired; and

shifting the x-ray head under command of the controller in a predetermined path based on the taught shape of the part portion for directing x-rays at different positions therealong while keeping the head at a substantially constant distance therefrom.

13. The method of claim 12 wherein the controller is taught the part portion shape by providing a remote control for use by an operator, operating the remote control to shift the head to the different positions from which x-rays are to be directed at corresponding different positions on the part portion, signaling the controller via the remote control with the different

positions of the head, and storing the different positions in memory of the controller to define the predetermined path of travel of the head along the shape of the part portion.